

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
14 December 2000 (14.12.2000)

PCT

(10) International Publication Number
WO 00/75227 A1

(51) International Patent Classification⁷: **C08L 33/04**,
101/04, C08K 3/00 // (C08L 33/04, 33:04, 101:04)

John [GB/GB]; 20 Laurel Road, Saltburn-by-the-Sea,
Cleveland TS12 1HU (GB).

(21) International Application Number: PCT/GB00/02139

(74) Agents: **BRIERLEY, Anthony, Paul et al.**; Appleyard
Lees, 15 Clare Road, Halifax HX1 2HY (GB).

(22) International Filing Date: 2 June 2000 (02.06.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
9912974.4 4 June 1999 (04.06.1999) GB
9922485.9 23 September 1999 (23.09.1999) GB

(71) Applicant (for all designated States except US): **INEOS
ACRYLICS UK LIMITED** [GB/GB]; 1st floor Queens
Gate, 15-16 Queens Terrace, Southampton, Hampshire
SO14 3BP (GB).

(81) Designated States (*national*): AE, AL, AM, AT, AU, AZ,
BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK,
DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL,
IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU,
LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT,
RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA,
UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,
IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG,
CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **EUSTACE, Paul**
[GB/GB]; 91 Prior Wood Gardens, Ingleby Barwick,
Stockton-on-Tees TS17 0YN (GB). **McCATHY, Neil, An-**
drew [GB/GB]; 36 Coulby Manor Farm, Coulby Newham,
Middlesbrough TS8 8RY (GB). **MARSTON, Nicholas,**

Published:

— With international search report.

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

WO 00/75227 A1

(54) Title: ACRYLIC MATERIAL

(57) Abstract: An acrylic material which is flame retardant comprises 4.9 to 94.9% by wt of an acrylic composition, 5-95% by wt of a halogen-containing polymer, especially PVC, and 0.1-25% by wt of an inorganic composition comprising at least one of an oxide, hydroxide, carbonate, borate, stearate, chloride or bromide, zinc, magnesium, molybdenum, antimony, aluminium, tin, copper, manganese, cobalt or iron.

BEST AVAILABLE COPY

higher class due to slumping. Addition of compounds with flame retardant capabilities to acrylic materials are well known in the art. For example use of organic phosphorous compounds as flame retardant materials in acrylic matrices are disclosed in JP06049312-A, GB2212807-A, DE3700373-A and GB2172600-A. J61051047-A discloses a PMMA composition for building material usage which contains calcium aluminate hydrate. This inorganic compound is believed to lose water at temperatures around 300°C and hence lessen the ability of the acrylic composition to burn. Other inorganic compounds that are known to have some flame retardant properties include various inorganic metal compounds. For example, US 4965309-A discloses a rigid flame retardant polyvinyl chloride (PVC) composition which contains inorganic zinc, magnesium and molybdenum compounds which are claimed to reduce smoke development on burning of the PVC. PVC itself may be used as an additive to impart flame retardant properties to other polymers.

It is an object of the invention to provide an acrylic material which has enhanced flame retardant properties and a method for its manufacture.

Accordingly, in a first aspect, the present invention provides an acrylic material which comprises:

- a) 4.9 to 94.9% by wt of an acrylic composition;
- b) 5 to 95% by wt of a halogen containing polymer which contains between 5 to 70% by wt of halogen;
- c) 0.1 to 25% by wt of an inorganic composition comprising at least one of an oxide, hydroxide, carbonate, borate,

stearate, chloride or bromide of zinc, magnesium, molybdenum, antimony, aluminium, tin, copper, manganese, cobalt or iron.

5 In a second aspect, there is provided a method of manufacturing an acrylic material which comprises:

a) 4.9 to 94.9% by wt of an acrylic composition;

10 b) 5 to 95% by wt of a halogen containing polymer which contains between 5 to 70% by wt of halogen;

c) 0.1 to 25% by wt of an inorganic composition comprising at least one of an oxide, hydroxide, carbonate, borate, stearate, chloride or bromide of zinc, magnesium, molybdenum, antimony, aluminium, tin, copper, manganese, cobalt or iron which process comprises melt blending, preferably between 150 to 250°C, said acrylic composition, said halogen containing polymer and said inorganic composition.

20

Said acrylic composition may comprise a homopolymer or a copolymer (which term includes polymers that have more than two different repeat units) of an alkyl(alk)acrylate or a copolymer comprising acrylonitrile, especially a copolymer which includes styrene and acrylonitrile, optionally in combination with other material (especially polymeric material).

25

Where said acrylic composition comprises an alkyl(alk)acrylate, it is preferably a homo or copolymer of at least one C₁-C₆alkyl(C₀-C₁₀alk)acrylate and is more preferably a copolymer made by polymerising a monomer mixture comprising 50-90 wt% of an alkyl methacrylate and

30

1-50 wt% of an alkyl acrylate. The alkyl methacrylate is preferably a C₁-C₄ alkyl methacrylate, for example methyl methacrylate. The alkyl acrylate is preferably a C₁-C₄ alkyl acrylate, for example methyl, ethyl or butyl acrylate. The molecular weight (M_w) of the alkyl(alk)acrylate is preferably at least 20,000 and, more preferably, is at least 50,000. The molecular weight may be 500,000 or less, preferably 200,000 or less, more preferably 150,000 or less.

10

Where said acrylic composition comprises a copolymer comprising acrylonitrile, it may be an acrylic-styrene-acrylonitrile (ASA) polymer, acrylonitrile-EPDM-styrene polymer (AES), styrene-acrylonitrile (SAN) polymer, olefin-styrene-acrylonitrile (OSA) polymer or acrylonitrile-butadiene-styrene (ABS) polymer, with ASA, AES and SAN being preferred.

20

Suitable copolymers comprising acrylonitrile include at least 15% by wt, more preferably at least 20% by wt, more preferably at least 25% by wt, especially at least 30% by wt of acrylonitrile; and less than 50% by wt, preferably less than 40% by wt, more preferably less than 35% by wt of acrylonitrile.

25

Suitable copolymers of acrylonitrile include at least 40% by wt, preferably at least 50% by wt, more preferably at least 55% by wt, especially at least 60% by wt styrene; and less than 80% by wt, preferably less than 70% by wt, more preferably less than 65% by wt, of styrene.

30

Where said polymer comprising acrylonitrile comprises a copolymer comprising acrylonitrile and styrene together

with another material, said material may be selected from an olefin, acrylic or EPDM. The amount of the latter mentioned components may be in the range 0 to 20% by wt, preferably 0 to 15% by wt, especially 0 to 10% by wt.

5

The acrylic composition (especially one comprising an alkyl(alk)acrylate) may comprise between 40-100 wt%, preferably 40-80wt%, of a copolymer as described above and between 0-60 wt%, preferably 0-40 wt%, more preferably 0-20 wt%, of a rubbery copolymer. By a rubbery copolymer, we mean materials which have a glass transition temperature which is less than room temperature, preferably less than 0°C, e.g. less than -20°C. We also include block copolymers which include a rubbery, low T_g block, often with harder, higher T_g blocks. Such materials are well known for use as toughening agents for improving the impact resistance of acrylic materials. Suitable rubbery copolymers include copolymers of acrylates, methacrylates, styrene, acrylonitrile and/or olefins (especially butadiene). Examples of suitable materials include styrene-butadiene rubbers, styrene-olefin copolymers, methacrylate-butadiene-styrene (MBS) terpolymers, styrene-acrylonitrile copolymers and core-shell type particles based on alkyl acrylates, e.g. butyl acrylate and styrene. Preferred types of rubbery copolymer are core-shell particles based on alkyl acrylates, as described in US-A-5318737.

The halogen containing polymer is preferably a chlorine-containing polymer. The only halogen in said polymer is preferably chlorine. Said polymer may be a chlorinated polyolefin, polyvinylidene chloride, polyvinylidene chloride or chlorinated PVC. Said polymer is preferably chosen from

30

a polymer or a copolymer of vinyl chloride or vinylidene chloride. The halogen-containing polymer is preferably polyvinyl chloride (PVC). The halogen containing polymer may contain additives known to those skilled in the art.

5 The halogen containing polymer may contain between 0 to 20% by wt of titanium dioxide or calcium carbonate filler or a mixture of both. Said halogen-containing polymer may include for example pigments, fillers, impact modifiers, lubricants, UV stabilisers, thermal stabilisers and
10 viscosity modifiers. Said halogen containing polymer suitably includes at least 75% by wt of polymer, preferably at least 80% by wt, more preferably at least 90% by wt, especially at least 95% by wt. Said halogen containing polymer may consist essentially of polymer.

15

Suitably, the halogen containing polymer, when considered in the absence of any fillers or other ingredients (e.g. thermal stabilisers or viscosity modifiers) includes at least 10% by wt, preferably at least 20% by wt, more
20 preferably at least 30% by wt, especially at least 40% by wt and most preferably at least 50% by wt of halogen, especially chlorine. The halogen containing polymer, preferably in the absence of said aforementioned ingredients, preferably includes less than 70% by wt,
25 preferably less than 60% by wt, especially less than 57% by wt halogen, especially chlorine. Preferably, said halogen containing polymer includes no halogen other than chlorine.

30 Said acrylic material may include at least 10% by wt, preferably at least 20% by wt, more preferably at least 25% wt, especially at least 30% by wt of said halogen containing polymer. Said acrylic material may include 75%

wt or less, preferably 60% by wt or less, more preferably 50% by wt or less of said halogen containing polymer.

5 The halogen containing polymer is preferably compatible with the acrylic composition such that it can be melt blended into the acrylic composition without much difficulty.

10 Said acrylic material may include at least 15% by wt, suitably at least 24.9% by wt, preferably at least 40% by wt, more preferably at least 50% by wt, especially at least 55% by wt of said acrylic composition. Said acrylic material suitably includes 90% by wt or less, preferably 80% by wt or less, more preferably 70% by wt or less, 15 especially 60% by wt or less of said acrylic composition.

Said inorganic composition preferably includes an anion selected from an oxide, borate, hydroxide or carbonate. A cation of said inorganic composition is preferably 20 selected from antimony, tin, zinc, magnesium and aluminium.

In one embodiment, the inorganic composition may be chosen from at least one of a borate, oxide or hydroxide of 25 aluminium, zinc, iron, magnesium and tin. More preferably the inorganic composition is chosen from two or three of a borate, oxide or hydroxide of aluminium, zinc, iron, magnesium and tin, for example magnesium hydroxide and zinc oxide or magnesium hydroxide and a blend of zinc 30 oxide and tin oxide (commonly referred to as zinc stannate).

Said acrylic material may include at least 0.5% by wt, suitably at least 1% by wt, preferably at least 2% by wt, more preferably at least 3% by wt, especially at least 4% by wt of said inorganic composition. In some cases, said acrylic material may include at least 5% by wt, or even at least 8% by wt. Said acrylic material may include less than 20% by wt, suitably 18% by wt or less, preferably 16% by wt or less, more preferably 14% by wt or less, especially 12% by wt or less of said inorganic composition. Where said inorganic composition includes more than one compound of the type described, the aforementioned amounts preferably refer to the sum of the amounts of respective compounds in said acrylic material.

In general terms, preferably said inorganic composition is arranged to provide at least two different anions and two different cations of the type described herein. In a preferred embodiment, said inorganic composition includes two distinct compounds for providing said two different anions and cations. The ratio of the weight of a first compound to a second compound in the inorganic composition may be at least 0.05, suitably at least 0.1, preferably at least 0.15, more preferably at least 0.18, especially at least 2. The ratio may be less than 10, suitably less than 5, preferably less than 2.5, more preferably less than 1.0, especially 0.5 or less. The % by wt of said first compound in said acrylic material may be at least 0.5, suitably at least 0.75, preferably at least 1.0, more preferably at least 1.5, especially at least 2. The % by wt of said first compound may be less than 10, preferably less than 5, more preferably 4 or less, especially 2.5 or less. The % by wt of the second compound in said acrylic material may be at least 0.5, suitably at least 1,

preferably at least 2.5, more preferably at least 5, especially at least 7.5. The % by wt of the second compound in said acrylic material may be less than 24.9, suitably less than 20, preferably less than 15%, especially 10 or less.

In one preferred embodiment, said first compound is an oxide of antimony and said second compound is magnesium hydroxide.

In another preferred embodiment, said first compound is zinc stannate and said second compound is magnesium hydroxide.

In a further preferred embodiment said inorganic composition comprises zinc stannate, zinc borate and magnesium hydroxide.

Said inorganic composition could include a composite compound arranged to deliver more than one anion or cation, for example magnesite. However, suitably, less than 20% wt, preferably less than 10% wt, more preferably less than 5% wt, especially substantially none of the inorganic composition is made up of a composite compound.

The weight average particle diameter of particles of said inorganic composition is suitably less than 250µm, preferably less than 100µm, more preferably less than 50µm, especially less than 10µm, suitably so that the material can have a high surface gloss. In some cases, the diameter may be smaller, for example less than 0.1 µm or below. In this case, the particles may be sufficiently small so that they do not scatter light when incorporated

into the acrylic material and, accordingly, clear acrylic materials may be made.

The ratio of the weight of said acrylic composition to said halogen containing polymer is preferably at least 0.5, more preferably at least 1, especially at least 1.3. The ratio may be less than 10, suitably less than 5, preferably less than 3, more preferably less than 2, especially 1.5 or less.

10

The ratio of the weight of said acrylic composition to said inorganic composition may be at least 8, preferably at least 10, more preferably at least 12, especially at least 13. The ratio may be less than 30, suitably less than 25, preferably less than 20, more preferably less than 18, especially less than 16.

Other additives such as UV stabilisers, colourants, lubricants etc that are commonly found in acrylic materials may be present in the acrylic material of the invention.

In a preferred embodiment, the method comprises melt blending by extrusion of the inorganic composition and the acrylic composition together at a temperature between 150 to 230°C, more preferably 180 to 220°C followed by melt blending with the halogen containing polymer. More preferably the melt blending by extrusion is of all the ingredients together between 150 to 230°C, more preferably 160 to 200°C and particularly 170 to 195°C.

The acrylic material may be made in the form of sheets, films, powders or granules. It may be used alone or as a

capstock material and extruded onto other plastics materials, for example rigid or foamed forms of ABS, PVC, polystyrene polymers including HIPS and other modified styrene polymers, or polyolefins. The material may also be
5 coextruded or laminated onto metals.

Material as described in the form of sheets (e.g. extruded or laminated sheets) may be thermoformed or otherwise formed into a desired shape by a suitable means.

10

The invention extends to an acrylic material which comprises :

a) 24.9 to 94.9% by wt of an acrylic composition;

15

b) 5 to 75% by wt of a halogen containing polymer which contains between 5 to 70% by wt of halogen;

20

c) 0.1 to 25% by wt of an inorganic composition comprising at least one of an oxide, hydroxide, carbonate, borate, stearate, chloride or bromide of zinc, magnesium, molybdenum, antimony, aluminium, tin, copper, manganese, cobalt or iron.

25

The invention further extends to a method of manufacturing an acrylic material which comprises:

a) 24.9 to 94.9% by wt of an acrylic composition;

30

b) 5 to 75% by wt of a halogen containing polymer which contains between 5 to 70% by wt of halogen;

c) 0.1 to 25% by wt of an inorganic composition comprising at least one of an oxide, hydroxide, carbonate, borate, stearate, chloride or bromide of zinc, magnesium, molybdenum, antimony, aluminium, tin, copper, manganese, cobalt or iron which process comprises melt blending, by extrusion, between 150 to 250°C, said acrylic composition, said halogen containing polymer and said inorganic composition.

10 An acrylic material as described herein may be supplied in the form of pellets. The pellets may then be thermally processed for any downstream application. Alternatively, a solid form (e.g. pellets) comprising said acrylic composition and said inorganic composition may be supplied for subsequent mixing with a said halogen-containing polymer. Thus, the invention extends to a solid form comprising said acrylic composition and said inorganic composition, wherein the "% by wt" expressed herein for said acrylic material and said inorganic composition represent "parts by weight" in said solid form.

The invention extends to a flame retardant component comprising an acrylic material according to said first aspect or manufactured in a method according to the second aspect.

Said component may be a coextruded or laminated component which includes said acrylic material.

30 Said component may be for use in construction.

Said component may be for use in construction of a building. For example, it could be a solid or coextruded

building component, for example a soffit board, barge board, fascia board, cladding board, siding, gutter, pipe, shutter, window casement, window board, window profile, conservatory profile, door panel, door casement, roofing panel, architectural accessory or the like.

Said component may be for use in constructing a vehicle or in another automotive application, both as a bulk material or as a coextruded laminate. Such applications include, but are not limited to, decorative exterior trim, vehicle cab moldings, bumpers (fenders), louvers, rear panels, accessories for buses, trucks, vans, campers, farm vehicles and mass transit vehicles, side and quarter panel trim or the like.

Said component may be used in indoor applications for example bathtubs, spas, shower stalls, counters, bathroom fixtures, toilet seats, kitchen housewares, sinks, and refrigerator liners or bodies. Said component may be used in outdoor applications, for example for fencing, trash cans, garden furniture, spas, signage and trim for signage use, such as for petrol stations (or the like). Outdoor applications suitably include the building and automotive components which are subjected to the external environment.

The invention further extends to a flame retardant component for an outdoor application comprising an acrylic material according to said first aspect or manufactured in a method according to the second aspect

The invention further extends to a flame retardant extrusion comprising an acrylic material according to said

first aspect or manufactured in a method according to the second aspect.

5 The invention extends to the use of a component made of an acrylic material according to the first aspect or manufactured in a method according to the second aspect in construction and/or in outdoor applications.

10 The invention extends to a building comprising a component made out of an acrylic material according to the first aspect or manufactured in a method according to the second aspect.

15 The invention extends to a component which includes a substrate and a capstock material wherein at least one of either the substrate or the capstock material is an acrylic material according to the first aspect or manufactured in a method according to the second aspect.

20 The acrylic material of the first aspect and/or a component for a use as described herein may have a size in at least one direction of at least 1 cm, suitably at least 5 cm, preferably at least 10 cm. Said material and/or component may have a volume of at least 50 cm³, preferably
25 at least 100 cm³, more preferably at least 500 cm³, especially at least 1000 cm³.

Any feature of any aspect of any invention or embodiment described herein may be combined with any feature of any
30 aspect of any other invention or embodiment described herein.

The invention will be further described with reference to the following Examples.

Example 1 - Preparation of Acrylic Material

5 A mixture of 40% by wt uPVC (containing 5% titanium dioxide, 8-10% calcium carbonate, 3% viscosity modifiers and 0.5 to 1% thermal stabilisers, 56% by wt of an acrylic copolymer comprising methylmethacrylate (97%) and ethyl acrylate (3%), 2% by wt zinc stannate (Flamtard S ex
10 Alcan), 1% by wt magnesium hydroxide, 1% by wt zinc borate and UV stabiliser (Tinuvin P from Ciba-Geigy) was compounded by extrusion at 190°C in a co-rotating, vacuum vented twin screw extruder. The acrylic material was then extruded at 190°C to form a sheet nominally 4mm in
15 thickness.

Example 2 - Surface spread of flame test for the Acrylic Material

A sample of the sheet (885 x 267 mm) was tested according
20 to BS476 Part 7 surface spread of flame test. The distance the material burned along a reference line positioned 100mm above the lower edge of the sample was measured. The sample was found to burn a maximum distance of 600mm after
410 seconds.

25

Example 3 - Comparative-Surface spread of flame test for acrylic copolymer

A sample of a sheet (885 x 267mm) of an acrylic copolymer comprising methylmethacrylate (97%) and ethyl acrylate
30 (3%) and UV stabiliser was tested according to BS476 Part 7 surface spread of flame test. This sample was found to have burned to 600mm in 240 seconds.

Example 4

A composition comprising 54.5% by weight of a standard acrylic moulding polymer (Diakon TM MG102 available from Ineos Acrylics), 40% by weight unplasticised PVC, 1% Mg(OH₂), 2% zinc stannate and 2% zinc borate together with 0.5% UV stabiliser (Tinuvin P from Ciba-Geigy) and 0.2% of a thermal stabiliser (Irganox 1076 from Ciba-Geigy) was melt blended as described in Example 1. The burning properties were measured, together with those of a sample made from unmodified MG102. The heat release rate was measured by cone calorimetry using a method described in ISO 5660 using an incident heat flux of 40 kW/m² and square samples measuring 100 x 100 mm x 4 mm thickness. The results are shown in Table 2.

Table 2

Composition	steady state rate of heat release (kW/m ²)	peak rate of heat release (kW/m ²)
MG102	650	750
Modified MG102	120	250

20 Example 5 - Preparation of Acrylic Material as a laminate with foamed uPVC

A mixture of 30% by wt uPVC (obtained from EVC), 50% by wt of a commercially available, high melt flow, impact-modified, acrylic moulding copolymer comprising 25 methylmethacrylate and ethyl acrylate, 2% by wt zinc stannate, 10% by wt magnesium hydroxide, 8% w/w colour masterbatch (a 50% pigment dispersion in acrylic) and UV stabiliser (Tinuvin P from Ciba-Geigy) was compounded by

extrusion at 190°C in a co-rotating, vacuum vented twin screw extruder. The acrylic material was then coextruded at 100 µm thickness onto foamed uPVC to form a nominally 6mm cladding board.

5

Example 6 - Surface spread of flame test for the Acrylic/foamed uPVC laminate

A sample of the sheet (885 x 267 mm) from Example 5 was tested using the BS476 Part 7 surface spread of flame apparatus. The distance the material burned along a reference line positioned 100mm above the lower edge of the sample was measured. The sample was found to burn to less than 100 mm after 90 seconds and to less than 100 mm after 600 seconds.

15

Example 7 - Comparative-Surface spread of flame test for acrylic copolymer / foamed uPVC laminate

A sample of nominally 6 mm cladding board (885 x 267mm) comprising a 100 µm capstock of an acrylic copolymer on a foamed uPVC substrate was also tested. The acrylic copolymer comprised a commercially available, high melt flow, impact modified, acrylic moulding copolymer of methylmethacrylate and ethylacrylate, UV stabiliser and 8% w/w colour masterbatch (a 50% pigment dispersion in acrylic). In the BS476 Part 7 surface spread of flame apparatus this sample was found to have burned to greater than 370mm in 90 seconds and less than 650 mm after 600 seconds.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this

specification, and the contents of all such papers and documents are incorporated herein by reference.

5 All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

10

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated
15 otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the
20 foregoing embodiment(s). The invention extend to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so
25 disclosed.

CLAIMS

1. An acrylic material which comprises:

- 5
- a) 4.9 to 94.9% by wt of an acrylic composition;
- b) 5 to 95% by wt of a halogen containing polymer which contains between 5 to 70% by wt of halogen;
- 10
- c) 0.1 to 25% by wt of an inorganic composition comprising at least one of an oxide, hydroxide, carbonate, borate, stearate, chloride or bromide of zinc, magnesium, molybdenum, antimony, aluminium, tin, copper, manganese,
- 15 cobalt or iron.

2. A method of manufacturing an acrylic material comprising:

- 20 a) 4.9 to 94.9% by wt of an acrylic composition;
- b) 5 to 95% by wt of a halogen containing polymer which contains between 5 to 70% by wt of halogen;
- c) 0.1 to 25% by wt of an inorganic composition comprising at least one of an oxide, hydroxide,
- 25 carbonate, borate, stearate, chloride or bromide of zinc, magnesium, molybdenum, antimony, aluminium, tin, copper, manganese, cobalt or iron which method comprises melt blending said acrylic composition, said halogen containing polymer and said inorganic
- 30 composition.

3. An invention according to claim 1 or claim 2, wherein said acrylic composition comprises a homopolymer or a

copolymer of an alkyl(alk)acrylate or a copolymer comprising acrylonitrile.

4. An invention according to any preceding claim, wherein
5 said acrylic material comprises 24.9 to 94.9% by wt of said acrylic composition.

5. An invention according to any preceding claim, wherein
10 said acrylic composition is a homo or copolymer of at least one C₁-C₆alkyl(C₀-C₁₀alk)acrylate.

6. An invention according to any preceding claim, wherein
15 said acrylic composition comprises a copolymer made by polymerising a monomer mixture comprising 50 - 90 wt% of an alkyl methacrylate and 1 - 50 wt% of an alkyl acrylate.

7. An invention according to any preceding claim, wherein
said acrylic composition comprises 20 - 60 wt% of a
20 rubbery copolymer.

8. An invention according to any preceding claim, wherein
said halogen-containing polymer is a polymer or copolymer
of vinyl chloride or vinylidene chloride.

25 9. An invention according to any preceding claim, wherein said halogen-containing polymer includes at least 10% by wt of halogen.

10. An invention according to any preceding claim, wherein
30 said halogen-containing polymer includes no halogen other than chlorine.

11. An invention according to any preceding claim, which includes at least 10% by wt and 75% weight or less of said halogen-containing polymer.
- 5 12. An invention according to any preceding claim, wherein said acrylic material includes at least 30% by wt and 90% by weight or less of said acrylic composition.
- 10 13. An invention according to any preceding claim, wherein said inorganic composition includes an anion selected from an oxide, borate, hydroxide or carbonate.
- 15 14. An invention according to any preceding claim, wherein said inorganic composition includes a cation selected from antimony, tin, zinc, magnesium and aluminium.
- 20 15. An invention according to any preceding claim, wherein said inorganic composition comprises at least one of a borate, oxide or hydroxide of aluminium, zinc, iron, magnesium or tin.
- 25 16. An invention according to any preceding claim, wherein said inorganic composition comprises an oxide of antimony and magnesium hydroxide.
- 30 17. An invention according to any of claims 1 to 15, wherein said inorganic composition comprises zinc stannate and magnesium hydroxide.
18. An invention according to any of claims 1 to 15, wherein said inorganic composition comprises zinc stannate, zinc borate and magnesium hydroxide.

19. An invention according to any preceding claim, wherein said inorganic composition includes magnesium hydroxide.

20. An invention according to any preceding claim, which
5 includes at least 0.5% by wt of said inorganic composition.

21. An invention according to any preceding claim, wherein the ratio of the weight of said acrylic composition to
10 said halogen-containing polymer is at least 0.5 and is less than 10.

22. An invention according to any preceding claim, wherein the ratio of the weight of said acrylic composition to
15 said inorganic composition is at least 8 and less than 30.

23. A flame retardant component for use in construction comprising an acrylic material according to and/or manufactured in a method according to any preceding claim.

20

24. Use of a component made of an acrylic material according to and/or manufactured in a method according to any of Claims 1 to 22, in construction.

25 25. A building comprising a component made out of an acrylic material according to and/or manufactured in the method according to any of Claims 1 to 22.

26. A component which includes a substrate and a capstock
30 material, wherein at least one of either the substrate or the capstock material is an acrylic material according to any of claims 1 to 22.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 00/02139

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C08L33/04 C08L101/04 C08K3/00 //(C08L33/04, 33:04, 101:04)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C08L C08K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 1 054 877 A (BASF AG) 11 January 1967 (1967-01-11) claims 1-9	1-6, 16
X	EP 0 857 757 A (AUSIMONT SPA ;NIPPON ZEON CO (JP)) 12 August 1998 (1998-08-12) tables 2-4	1, 2, 15
X	EP 0 784 077 A (LINTEC CORP ;ASAHI KAGAKU KOGYO CO LTD (JP)) 16 July 1997 (1997-07-16) claim 1	1, 2, 15
X	US 4 595 724 A (KOBLOITZ FRANCIS F) 17 June 1986 (1986-06-17) examples 1-4	1, 2, 15, 16

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

15 September 2000

Date of mailing of the international search report

29/09/2000

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Siemens, T

INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No
PCT/GB 00/02139

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 1054877 A		DE 1444030 A	02-01-1969
EP 0857757 A	12-08-1998	IT MI970269 A	11-08-1998
		JP 10219064 A	18-08-1998
		US 5902860 A	11-05-1999
EP 0784077 A	16-07-1997	JP 9194664 A	29-07-1997
		US 5851653 A	22-12-1998
US 4595724 A	17-06-1986	NONE	